

# III Examples of Volcanic Eruptions

## Topic 8 Eldfell

Eldfell is a volcanic mountain on Heimaey, a small island off the south coast of Iceland located near the mid-Atlantic Ridge. Eldfell formed during a five-month period in 1973 from lava and tephra that flowed or was ejected from a newly opened fissure on the island. The tephra covered nearly half the island and burned or buried 50 homes in its only village, Vestmannaeyjar. The roofs of the other homes in the village had to be continually swept clear of tephra to prevent their collapse. The flowing lava added almost three square kilometers to the east side of the island. It also threatened to block the entrance of the village harbor. This was a serious problem because Vestmannaeyjar is Iceland's chief fishing port. The villagers attacked the lava flow by pumping seawater on it in the hope that the water would cool the lava enough to stop its advance. The pumping continued until the volcano fell silent four months later. The lava had stopped 165 meters short of the cliffs on the opposite side of the harbor, and the entrance to the harbor remained open.

Eldfell was an example of a rift eruption. Heimaey, along with the other areas of Iceland, is one of the few places in the world where a mid-ocean ridge is above sea level. Iceland is a part of the mid-Atlantic Ridge.

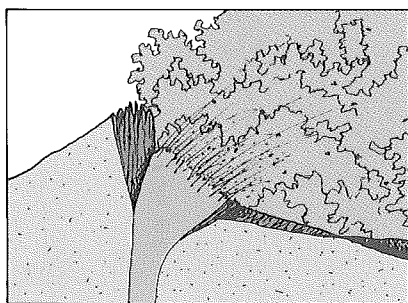
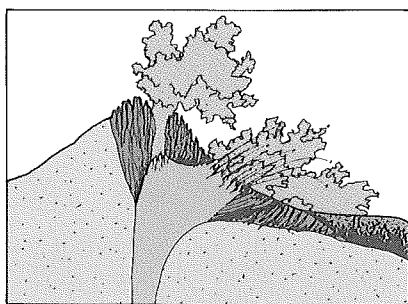
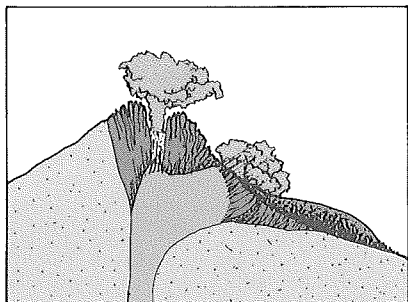
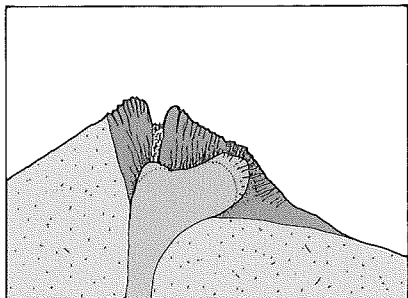
### OBJECTIVES

- A** Discuss the cause and nature of the 1973 eruption of Eldfell, the 1980 eruption of Mount St. Helens, and the regular eruptions of Kilauea.
- B** Give the cause and some of the results of some famous volcanic eruptions of the past.
- C** Discuss the volcanism that occurs on the moon, Mars, and Io.

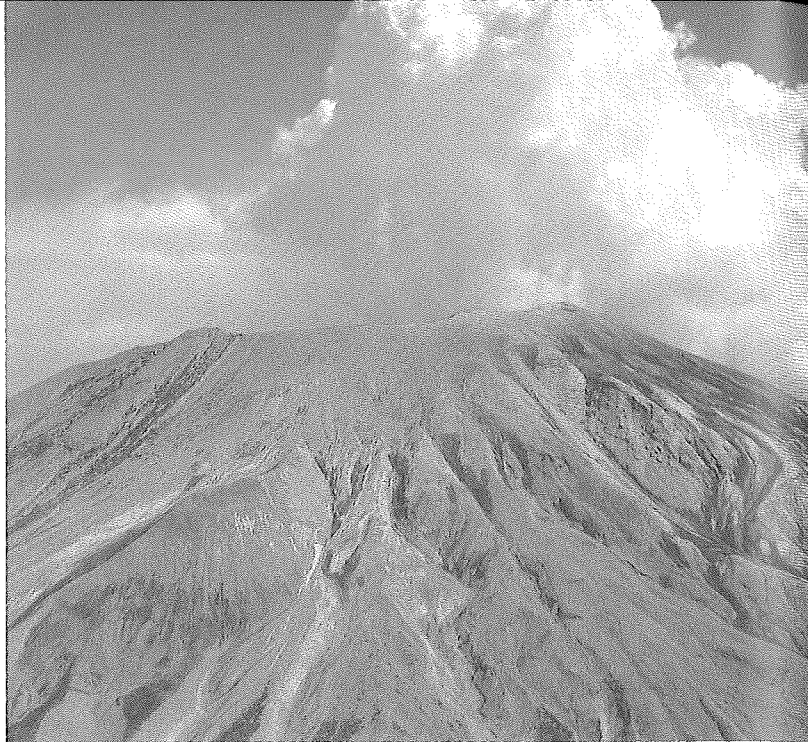
**14.8** The village of Vestmannaeyjar was nearly buried by tephra from the eruption of Eldfell in 1973.



**14.9** Mudflows and ash covered the area near Mount St. Helens after the eruption.



**14.10** This was the series of events during the major eruption of Mount St. Helens in 1980.



## Topic 9 Mount St. Helens

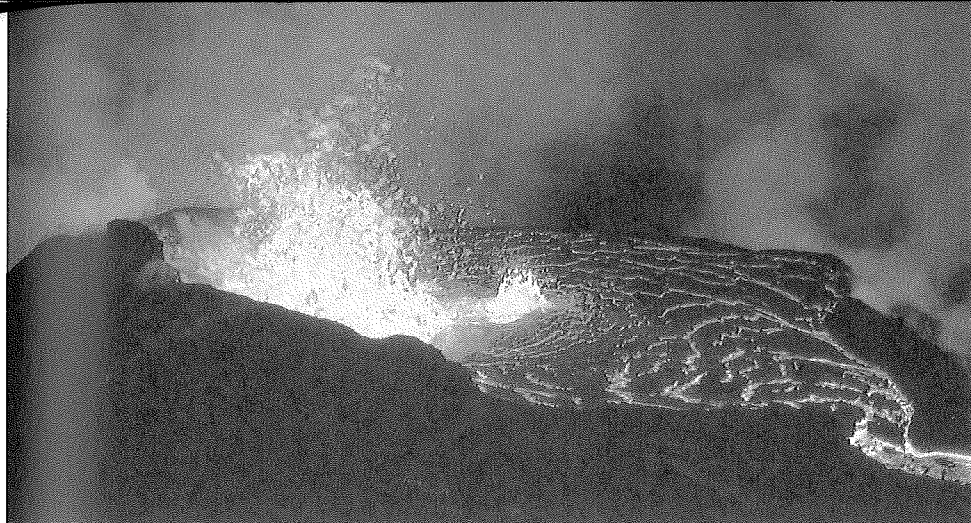
Mount St. Helens, located in Washington, is one of 15 major volcanoes in the Cascade Range. Its eruption in 1980 was the first volcanic activity in that range since 1921.

Signs of renewed activity in Mount St. Helens began in March 1980, two months before the major eruption. During that period, earthquake activity increased, a bulge in the north side of the cone grew larger, and small eruptions of steam and ash occurred. The major eruption involved four separate but related events:

1. An earthquake broke the bulge on the north side of the cone.
2. The bulge became a landslide.
3. An explosion of steam and superheated ash came from the magma, water, and gases that had been trapped under the bulge.
4. Mudflows formed when ash mixed with the melted snow and ice on the mountain.

The explosion blew down trees 25 kilometers away and rattled windows 160 kilometers away. The cloud of steam and ash was shot 20 kilometers into the air and its dust traveled around the world. Ash fall was heavy—2 to 5 centimeters—over hundreds of square kilometers. Mudflows and landslides accumulated to depths of over 180 meters in some areas.

Mount St. Helens and the other Cascade volcanoes are the result of subduction boundary volcanism. The two converging plates are the Juan de Fuca Plate and the North American Plate. The Juan de Fuca Plate is plunging eastward under the overriding North American Plate. The eruption that resulted at Mount St. Helens was typical of subduction boundary eruptions. It contained very little lava but large amounts of tephra and gases.



**14.11** Spectacular lava flows have been a common feature during eruptions of Kilauea.

## Topic 10 Kilauea

Kilauea is a shield volcano on the island of Hawaii. Kilauea has erupted at least once a year since 1952. Some of the eruptions have featured spectacular lava flows.

Kilauea and the other active Hawaiian volcanoes result from a hot spot under the island (Topic 7). In the case of Kilauea, the magma is thought to come from a depth of at least 50 kilometers below the surface. After rising, it is stored in an irregular reservoir about four kilometers below the top of the volcano.

A unique feature of Kilauea is the lakes of lava that form in depressions in the gently sloping volcanic cone. The lava from the reservoir erupts onto the surface and flows through natural channels to these depressions. When the lava flow stops, the lake starts to harden into rock. Sometimes this takes 25 years. During that time, the lava lake provides volcanologists with great amounts of information on magma and the changes that occur as it hardens.

The lava flows from Kilauea often threaten homes and communities on the island. In 1986, a flow covered a stretch of Kalapana Highway. People who lived beyond the blocked area had to drive as much as 100 extra kilometers to get their mail and groceries.

## Topic 11 Some Famous Eruptions

Most volcanoes that become well known occur along subduction boundaries. This is because most subduction boundary eruptions are often dramatic and violent.

Vesuvius and the other volcanoes of the Mediterranean are caused by the subduction of the African Plate beneath the Eurasian Plate. Because their lava is extremely thick and gas-rich, their eruptions are very explosive. The eruption of Vesuvius in A.D. 79 is probably the most famous volcanic eruption in history because it buried and preserved three Roman cities. Pompeii, the largest of the preserved cities, was buried in ash. Vesuvius has been active repeatedly since A.D. 79.

Krakatau, a volcanic island in the Indonesian chain, was





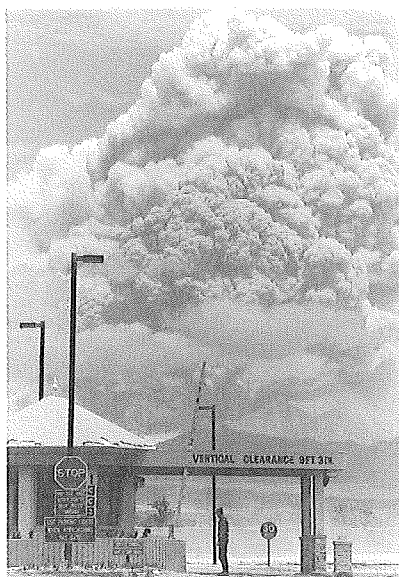
**14.12** An aerial view of Crater Lake shows Wizard Island in the middle of the lake. The island is the top of a volcanic cone that formed inside the original huge caldera.

formed by the subduction of the Indian Plate under the Eurasian Plate. On August 27, 1883, an eruption took place that has been described as "the most violent eruption of historic times." More than half of the island was destroyed and blown away in the explosion. The ash cloud reached nearly 30 kilometers into the air.

The compression wave caused by the Krakatau eruption broke windows 150 kilometers away, and the sound was heard 3000 kilometers away in Australia. Great sea waves flooded nearby coasts, and 36 000 people were drowned. The waves even reached the shore of South Africa over 8000 kilometers away. The fine volcanic dust from the eruption was carried completely around the world by upper-air winds. It caused strangely beautiful sunrise and sunset skies for two years after the eruption.

Crater Lake in Oregon is all that remains of a volcano that erupted violently about 7000 years ago. The eruption deposited a blanket of ash as thick as 15 meters over distances of 50 kilometers. The top of the cone collapsed after the lava that had supported it flowed out through cracks in the sides and base. The huge crater, or caldera, that resulted has since filled with rain and melted snow forming the deepest lake in the United States. Crater Lake is 608 meters deep. (Lake Baikal in Russia, at 1706 meters, is the deepest lake in the world.) Crater Lake, like the volcanoes in the Cascade Range, resulted from the subduction of the Juan de Fuca Plate under the North American Plate.

After having been inactive for 635 years, Mount Pinatubo in the Philippines erupted in June 1991. The eruption is ranked as the biggest volcanic eruption of this century. It was caused by the Pacific Plate subducting beneath the Philippine Plate. The eruption of Mount Pinatubo injected more than 20 million tons of sulfur dioxide and ash into the upper atmosphere. During the fall and winter of 1991 and 1992, Pinatubo's spreading ash clouds engulfed much of Earth's atmosphere, causing vivid sunsets. Scientists have been studying the potential effects this eruption may have on Earth's climate and on the Antarctic ozone hole.



**14.13** The explosive eruption of Mount Pinatubo sent ash and sulfur into the upper atmosphere.

## Topic 12 Extraterrestrial Volcanism

Lava flows on the moon erupted through cracks in the surface of the lunar lithosphere. Both the cracks and the heat needed to form the lava may have been the result of the bombardment by huge rocks from space. The bombardment formed the basins that the lava later filled.

Could the lavas have resulted from lunar plate tectonics? There is no evidence that they did or that such activity exists on the moon today. The moon's lithosphere is too thick to break or move.

The largest known volcanic cone in the solar system is on Mars. It is called *Olympus Mons*. The cone is 26 kilometers high and 500 to 600 kilometers across. The huge size of the Martian volcanoes is one piece of evidence that Mars does not have moving plates near its surface.

Io is a moon of Jupiter that has more than 100 active and inactive volcanoes. It has been proposed that the ejected materials are sulfur and sulfur dioxide. Io is caught in a gravitational tug-of-war between Jupiter and two other moons. As a result, some parts of Io's surface regularly move up and down by as much as 100 meters. The heat produced by the friction of this up-and-down motion is thought to be great enough to cause volcanism.



**14.14** Olympus Mons is the largest known volcanic cone in the solar system.

### TOPIC QUESTIONS

Each topic question refers to the topic of the same number.

8. (a) What kinds of materials were ejected from Eldfell? (b) What did the residents of Vestmannaeyjar do to save their harbor? (c) What kind of eruption was Eldfell?
9. (a) What activities preceded the 1980 Mount St. Helens' eruption there? (b) List the four major events that occurred with the eruption. (c) identify some results of the eruption.
10. (a) Where is Kilauea? (b) What is the cause of volcanic activity there? (c) Why are the lava lakes of Kilauea important?
11. (a) What is the cause of the eruptions of Vesuvius? (b) Why are the eruptions of Vesuvius so explosive? (c) What is the cause of the volcanic activity at Krakatau and the other Indonesian islands? (d) List some events that resulted from the eruption of Krakatau. (e) What happened at Crater Lake after the volcano erupted? (f) Why is the eruption of Mount Pinatubo important?
12. (a) What is thought to have caused the lava flows on the moon? (b) Why is plate tectonics not likely on the moon? (c) What evidence is there that Mars lacks moving lithospheric plates like Earth's? (d) What is thought to be the cause of the volcanic activity on Io?